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FLOOD INSURANCE STUDY

CITY OF CLAY CITY, KENTUCKY

POWELL COUNTY

SEPTEMBER 6, 1989

Federal Emergency Management Agency

COMMUNITY NUMBER 210195

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY

CITY OF CLAY CITY,
POWELL COUNTY,
KENTUCKY

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Clay City, Powell County, Kentucky, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by GRW Engineers, Inc., (the Study Contractor) for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-86-C-2245. This study was completed in October 1987.

Adjustments were made by FEMA to the Red River hydraulic analysis upstream of Mountain Parkway based on engineering judgment.

1.3 Coordination

On January 30, 1986, an initial meeting was held with representatives of FEMA, Clay City, and the Study Contractor. Coordination with city officials and Federal, State, and regional agencies produced a variety of information pertaining to floodplain regulations, available community maps, flood history, and other hydrologic data.

The U.S. Geological Survey (USGS); the Kentucky Division of Water, Dam Safety and Floodplain Compliance Division; and the U.S. Soil Conservation Service were contacted for data concerning flood discharges and elevations.

On April 25, 1988, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Clay City, Powell County, Kentucky. The area of study is shown on the Vicinity Map (Figure 1).

Flooding caused by overflow of the Red River and Brush Creek was studied in detail.

Areas having low development potential or minimal flood hazards were previously studied using approximate analyses. The results were shown on the Flood Hazard Boundary Map for the City of Clay City, Kentucky (Reference 1) and are incorporated into this Flood Insurance Study.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through October 1992. The scope and methods of study were proposed to and agreed upon by FEMA and the City of Clay City.

2.2 Community Description

Clay City is in western Powell County in southeast-central Kentucky, approximately 32 miles southeast of the City of Lexington, Kentucky, and is surrounded by the unincorporated areas of the county. The 1985 population of Clay City was reported to be 1,485 (Reference 2).

The climate in Clay City and the surrounding area is temperate, with moderately cold winters and warm, humid summers. Precipitation averages about 46 inches annually and is fairly well distributed throughout the year (References 3-6).

The Red River, a tributary of the Kentucky River, flows northerly and then southerly after a sharp bend, virtually encircling most of Clay City. Within the study area, the river width between banks ranges from 90 to 162 feet. The headwaters of the river are in the extreme eastern end of Wolf County, which is immediately southeast of Powell County.

Most of the developed areas of Clay City, which are primarily residential, lie within the 100-year floodplain.

2.3 Principal Flood Problems

Although the precipitation is fairly well distributed throughout the year, gage records indicate that higher discharges for the Red River tend to occur in winter and early spring.

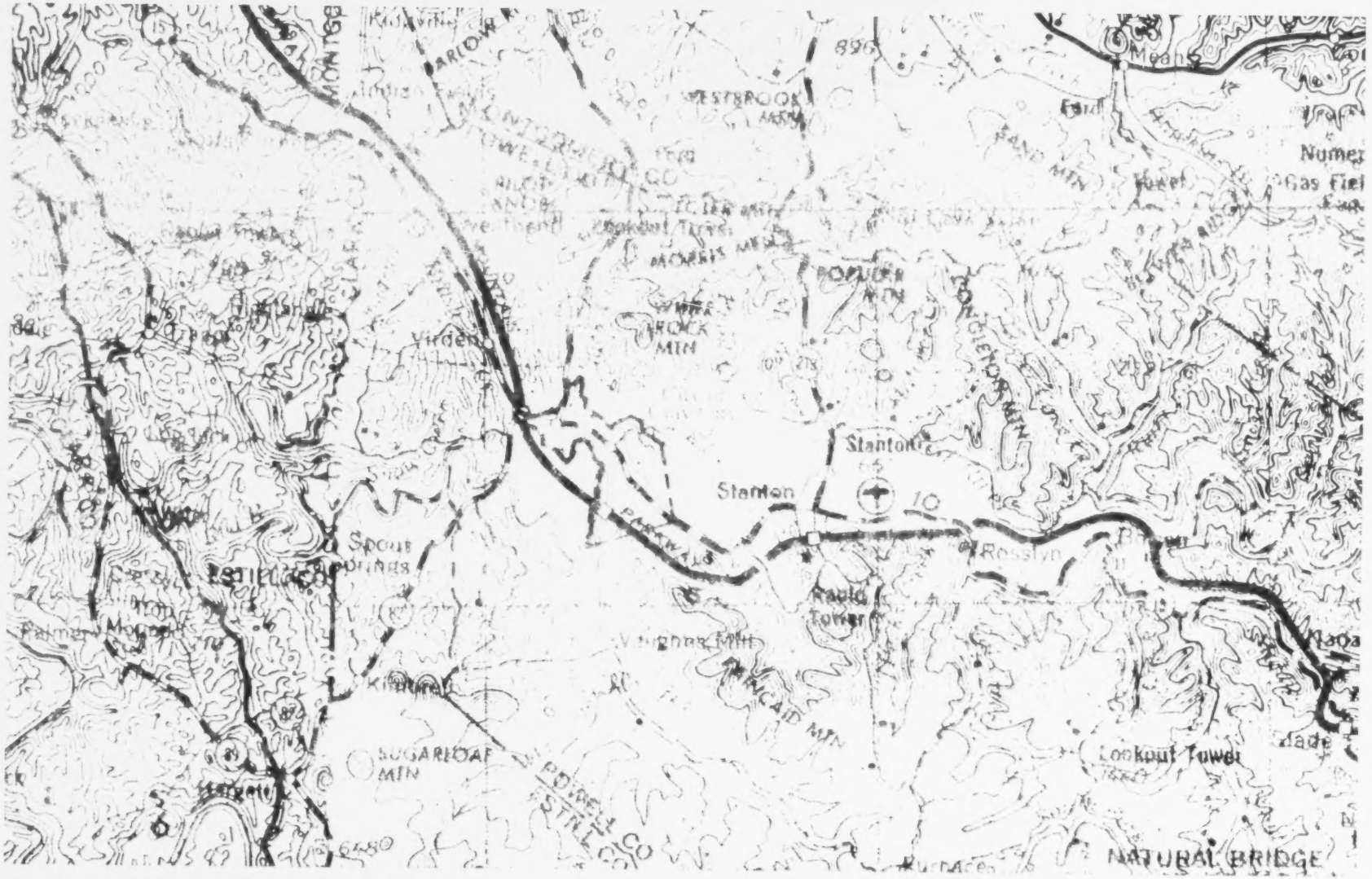

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CLAY CITY, KY
(POWELL CO.)

APPROXIMATE SCALE

VICINITY MAP

The USGS has operated a gaging station (no. 03283500) on the Red River at Clay City from 1930 to 1932 and from 1938 to the present. The highest crest ever recorded at the gage was 627.22 feet National Geodetic Vertical Datum of 1929 (NGVD) on December 9, 1978 (Reference 7). Based upon a USGS flood frequency analysis, this event has an estimated recurrence interval of about 100 years.

2.4 Flood Protection Measures

Structural flood protection measures are not known to exist within the study area.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

The discharges for the portion of the Red River downstream of the Clay City gaging station were determined using methods outlined in the USGS report titled "Techniques for Estimating Magnitude and Frequency of Floods in Kentucky" (Reference 8). That publication also outlines methods for determining discharges of ungaged streams, and those methods were applied in the hydrologic analysis of Brush Creek (Reference 7). In both cases, 10-, 50-, and 100-year discharges were obtained and, from those three values, a 500-year discharge was calculated using a regression analysis of the discharge versus log-of-return-interval relationship.

The discharges for the portion of the Red River upstream of the Clay City gaging station were obtained from the results of a USGS floodflow frequency analysis using a standard log-Pearson Type III statistical analysis as outlined in Bulletin No. 17 (Reference 9).

Peak discharge-drainage area relationships for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
RED RIVER					
about 2,000 feet downstream of Mountain Parkway	369.8	18,800	29,600	34,700	45,600
at Sixth Avenue	362.0	17,690	25,880	29,380	37,560
BRUSH CREEK					
at mouth	5.8	1,170	1,760	2,030	2,620

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections, bridge sections, and culvert sections were obtained from field surveys.

Locations of selected cross sections used in the the hydraulic analyses are shown on the Flood Profiles and on the Flood Insurance Rate Map.

Roughness coefficients (Manning's "n") used in the hydraulic computations were based on engineering judgment and field observation of the streams and floodplain areas. For all streams, roughness values range from 0.045 to 0.070 for the channel and from 0.075 to 0.100 for the overbank areas.

Water-surface elevations of floods of the selected recurrence intervals were computed using the HEC-2 step-backwater computer program (Reference 10). Starting water-surface elevations were calculated using the slope-area method.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. In cases where the 50- and 100-year flood elevations are close together, due to limitations of the profile scale, only the 100-year profile has been shown.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the NGVD. Elevation reference marks used in this study are shown on the map and described in the exhibit labeled Elevation Reference Marks.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at scales of 1:24000 and 1:6000, each with a contour interval of 20 feet (References 11 and 12).

The 100-year and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE) and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary was delineated using the Flood Hazard Boundary Map for the City of Clay City (Reference 1).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a

tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways for this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 2, Floodway Data. The computed floodways are shown on the Flood Insurance Rate Map. In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown. Portions of the floodways for the Red River and Brush Creek lie outside the corporate limits.

Along streams where floodways have not been computed, the community must ensure that the cumulative effect of development in the floodplain will not cause more than a 1.0-foot increase in the base flood elevations at any point within the community.

The area between the floodway and the 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

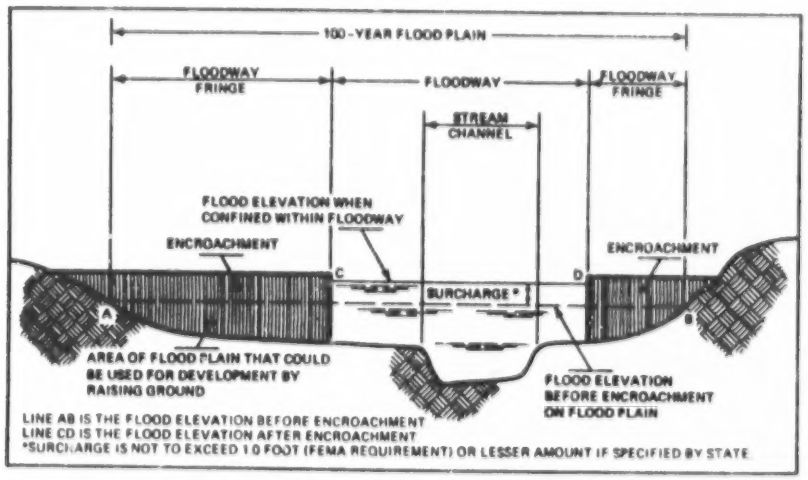
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE *
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FIGURE 2 - Floodway Schematic

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
RED RIVER								
A	17,400	1600	24,059	1.4	626.3	626.3	627.3	1.0
BRUSH CREEK								
A	150[3]	67	499	4.1	628.5	613.7[4]	614.7	1.0
B	1550[3]	307	1495	1.4	628.6	616.1[4]	617.0	0.9
C	3581[3]	379	1775	1.1	628.7	622.4[4]	623.3	0.9
D	4151[3]	330	1408	1.4	628.7	622.9[4]	623.9	1.0

[1]FEET ABOVE STATE ROUTE 82
[2]FEET ABOVE CONFLUENCE WITH RED RIVER
[3]THIS WIDTH EXTENDS BEYOND CORPORATE LIMITS
[4]ELEVATIONS WITHOUT CONSIDERING OVERFLOW EFFECT FROM RED RIVER

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CLAY CITY, KY
(POWELL CO.)

FLOODWAY DATA

RED RIVER – BRUSH CREEK

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

The Flood Insurance Rate Map printed for Powell County, Kentucky (Reference 13) does not contain base flood elevations and therefore is not in agreement with this study.

This Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for Clay City, Kentucky (Reference 1).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 1371 Peachtree Street, NE., Suite 736, Atlanta, Georgia 30309.

9.0 REFERENCES AND BIBLIOGRAPHY

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2. Kentucky Department of Economic Development, Kentucky Economic Statistics, Commonwealth of Kentucky, 1986.

3. U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Montgomery County, Kentucky, 1986.

4. ————, Soil Conservation Service, Soil Survey of Menifee and Rowan Counties and Northwestern Morgan County, Kentucky, December 1974.

5. ----------, Soil Conservation Service, Soil Survey of Estill and Lee Counties, Kentucky, August 1974.

6. Withington, William A., Kentucky in Maps, Lexington, Kentucky, August 1980.

7. U.S. Department of the Interior, Geological Survey, Water-Data Report KY-85-1, Water Resources Data: Kentucky Water Year 1985.

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9. U.S. Water Resources Council, Bulletin No. 17, Guidelines for Determining Flood Flow Frequency, March 1976.

10. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Computer Program 723-X6-L202A, Davis, California, April 1984.

11. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 20 Feet: Clay City, Kentucky, 1966.

12. GRW Engineers, Inc., Topographic Map, Scale 1:6000, Contour Interval 20 Feet: Lexington, Kentucky, September 1987.

13. Federal Emergency Management Agency, Flood Insurance Rate Map, Powell County, Unincorporated Areas, Kentucky, September 1985.

Chow, Ven Te, Handbook of Applied Hydrology, New York: McGraw-Hill Book Company, Inc., 1964.

Chow, Ven Te, Open-Channel Hydraulics, New York: McGraw-Hill Book Company, Inc., 1959.

U.S. Department of the Interior, Geological Survey, Roughness Characteristics of Natural Channels, 1967.

ELEVATION REFERENCE MARKS

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
1	0001	625.39	chiseled square in southeast corner of concrete slab at sign post located 35 feet west of centerline of State Route 1057 at northwest corner of gravel turnaround, about 2,000 feet south along State Route 1057 from bridge over Mountain Parkway
2	0001	655.38	chiseled square in southwest corner of State Route 1057 bridge over Mountain Parkway, 20 feet west of centerline of road
3	0001	622.21	chiseled square in top of outlet of 12-inch pipe culvert located 20 feet east of 12th Street, 50 feet north of State Route 1057
4	0001	652.18	U.S. Coast & Geodetic Survey brass disk stamped "X-158" located on north side of Clay City Elementary School
5	0001	636.31	aluminum disk set in concrete barrier at northeast corner of 6th Avenue bridge over the Red River
6	0001	628.50	chiseled square in top of inlet located at northeast corner of intersection of 1st Street and 1st Avenue
7	0001	630.76	top of fire hydrant located at southeast corner of intersection of 6th Avenue and 10th Street
8	0001	622.15	chiseled square in west side of headwall located 30 feet north of 6th Avenue, 840 feet from intersection of 10th Avenue and 6th Avenue
9	0001	629.83	chiseled square in top of 15-inch pipe culvert located about 0.64 mile east of intersection of 6th Avenue and 10th Avenue, 50 feet south of centerline of 6th Avenue

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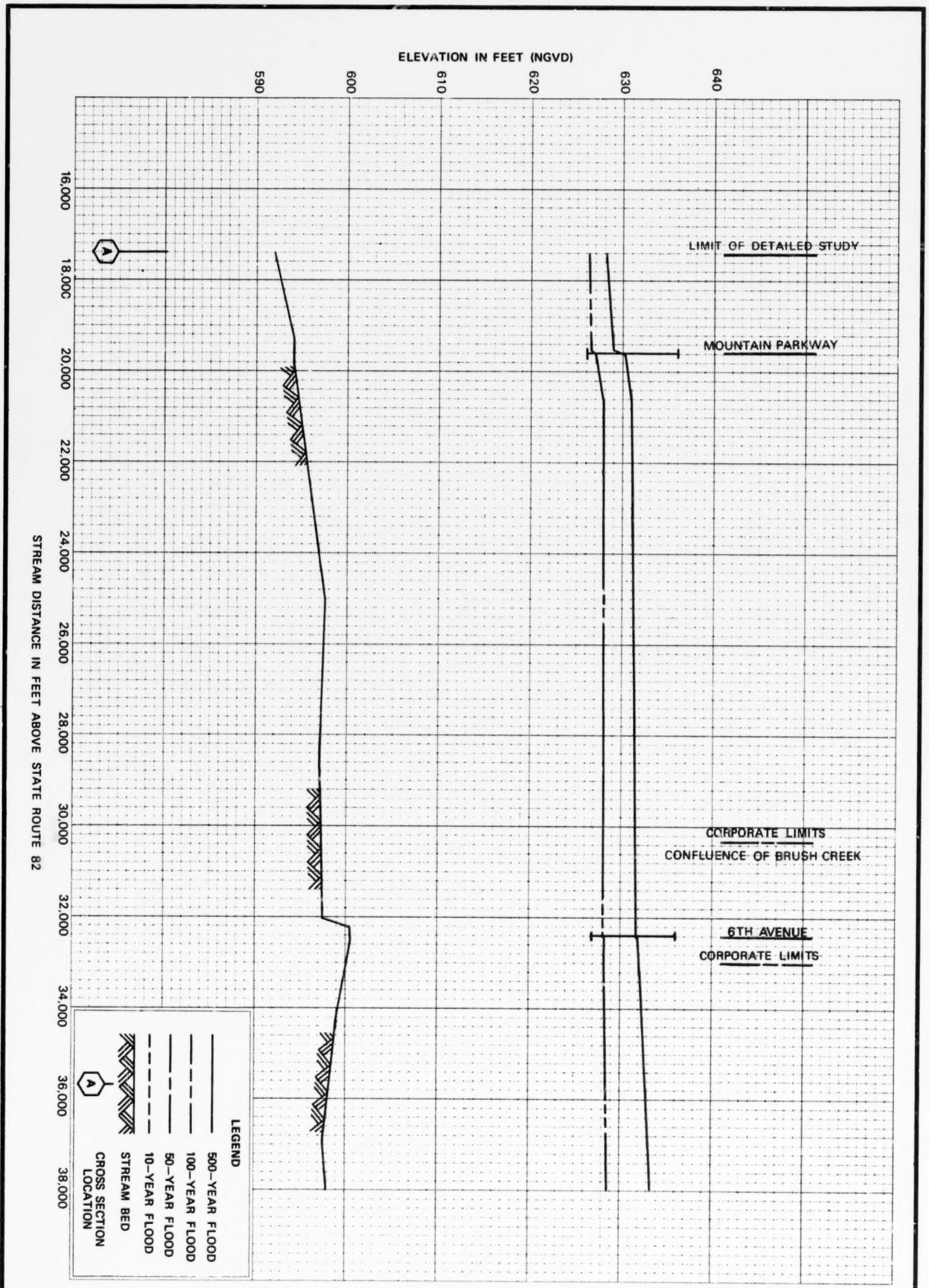
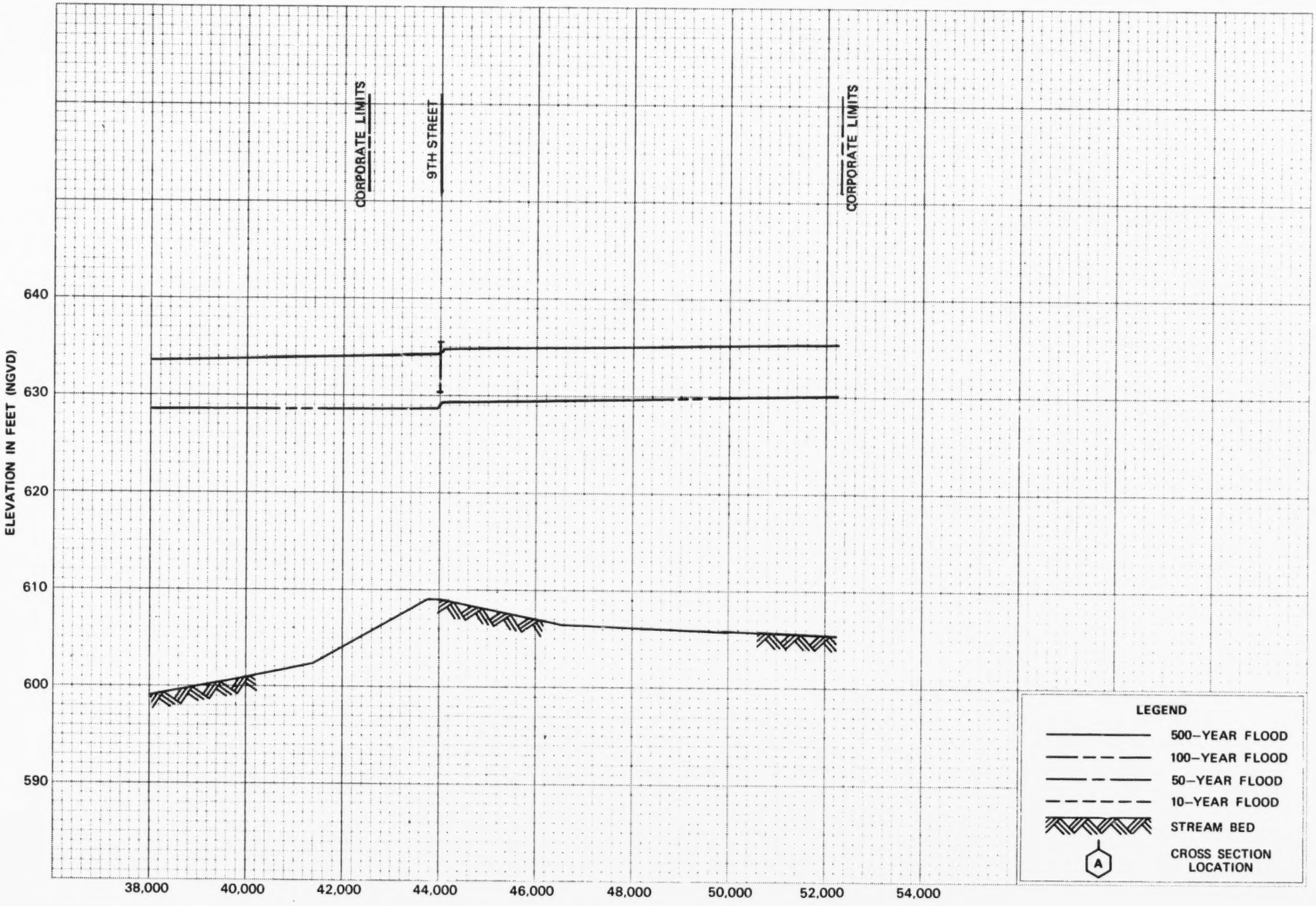
ELEVATION REFERENCE MARKS (Continued)

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
10	0001	623.06	chiseled square in northwest corner of abutment of Old Waltersville Road bridge over Brush Creek
11	0001	622.04	chiseled square in northwest corner of concrete headwall located on north side of Sixth Avenue, about 700 feet west of intersection of Sixth Avenue and Old Waltersville Road



01P	FEDERAL EMERGENCY MANAGEMENT AGENCY **CITY OF CLAY CITY, KY** (POWELL CO.)	**FLOOD PROFILES** **RED RIVER**



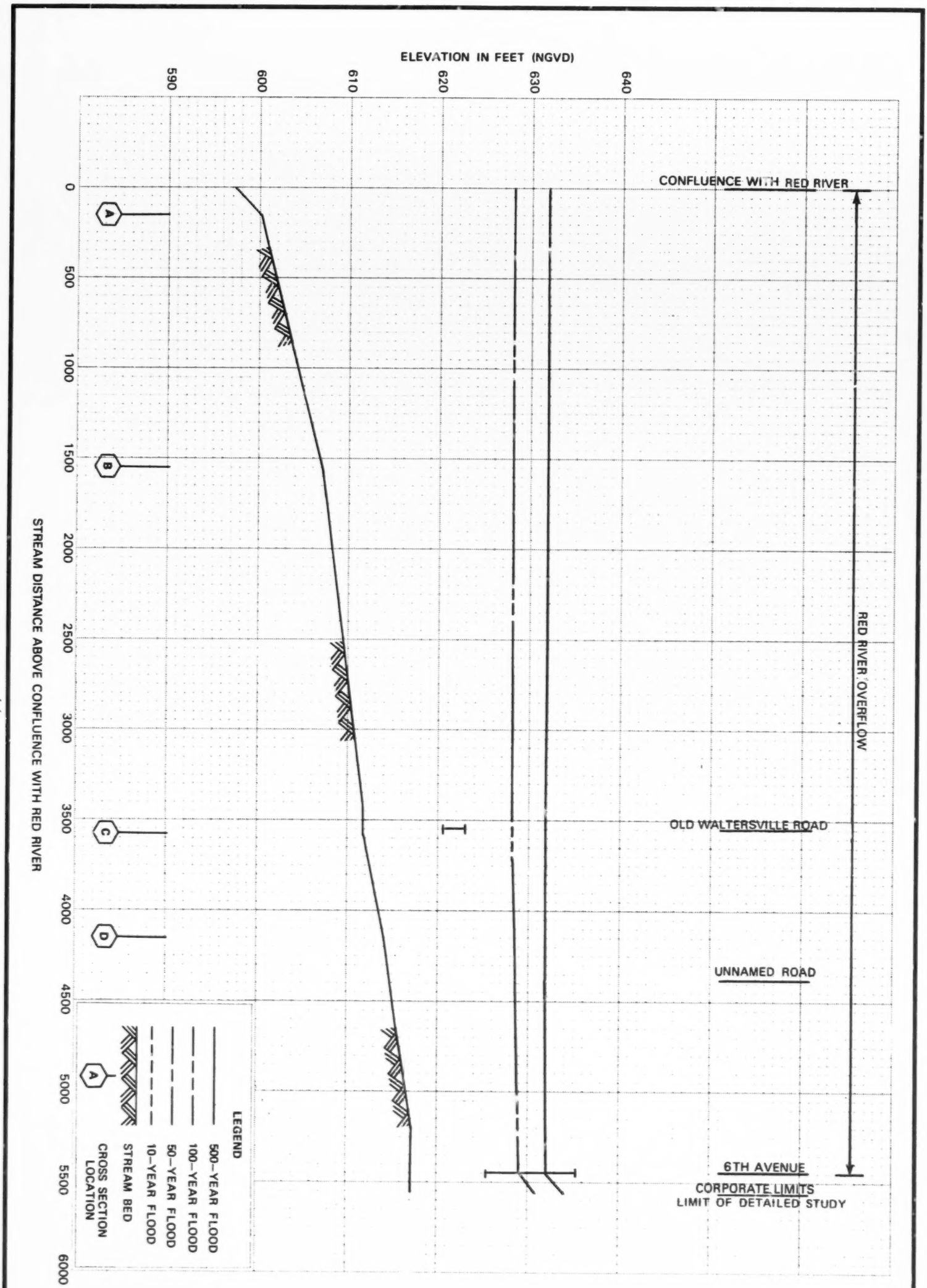
FLOOD PROFILES

RED RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CLAY CITY, KY
(POWELL CO.)

02P



03P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF CLAY CITY, KY
(POWELL CO.)

FLOOD PROFILES

BRUSH CREEK